

Lives on the Line: Every Minute Counts!

**Satellite Conference
Wednesday, July 14, 2004
2:00-4:00 p.m. (Central Time)**

Produced by the Alabama Department of Public Health
Alabama Public Health Training Network

Faculty

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Objectives

Cyanide Antidote Kit:

1. Describe the mechanism of toxicity and resulting clinical findings in a cyanide exposure.
2. Describe the contents of the Cyanide Antidote Kit.
3. Describe the proper administration of the components of the Cyanide Antidote Kit.

Objectives

Cyanide Antidote Kit (continued):

4. Describe indications for repeated use of the components of the Cyanide Antidote Kit.
5. Describe other therapies which might be necessary in conjunction with the use of the Cyanide Antidote Kit.

Objectives

Mark I Kit:

1. Be familiar with the contents of the Mark I Kit.
2. Understand the indications for use of the Mark I Kit.
3. Describe the proper use of the autoinjectors in the kit.
4. Describe adverse effects and potential hazards of using the Mark I Kit.

Objectives

Mark I Kit (continued):

5. Describe indications for administration of contents of additional Mark I Kits.
6. Understand other therapies which might be necessary after administration of the Mark I Kit contents.

Cyanide

- Molecular Weight: 26 Daltons
- Odor Threshold: 1-5 ppm
 - Detectable by 60% of population
- Life Threatening: 110 ppm (>30 min)
- Immediately Fatal: 270 ppm
- Estimated Oral Fatal Dose: 100 mg

Cyanide - Sources

- Industry
 - Electroplating
 - Photography
 - Metal Refining
 - Fumigation
- Product of Combustion
 - Wool, Silk
 - Artificial Rubber, Polyurethane, Other Plastics
- Cyanogenic Glycosides
- Consumer Products: Acetonitrile
- Medicine: Nitroprusside

Non-Industrial Uses

- Agent of Homicide
 - Jonestown 1978 (over 900 deaths)
 - Tylenol™ 1982
- Agent of Terrorism
 - Agricultural Terrorism 1989
 - First World Trade Center Bombing

Cyanide: Action

- Causes Cellular Hypoxia
 - High Affinity for Ferric (+3) Irons
 - Cytochrome Oxidase in Electron Transport
 - Anaerobic Metabolism
 - Profound Acidosis
- Vasodilation

Cyanide Effects

- Abrupt loss of consciousness
- Seizure activity
- Hyperventilation
- Profound acidosis
- Profound hypotension
- Death

Cyanide Therapy

- Decontaminate
- Supportive therapy
- Specific Antagonists: Cyanide Antidote Kit
 - Oxygen
 - Nitrites
 - Thiosulfate

Antidote Kit: Actions

- Create a pool of Ferric (+3) Iron
 - Hemoglobin has iron in the ferrous (+2) state
 - Oxidizers can convert ferrous to Ferric Iron
 - Hemoglobin with Ferric Iron forms Methemoglobin

Antidote Kit: Actions

- Attract Cyanide from Cytochrome Oxidase
 - Cyanide has high affinity for Methemoglobin
- Convert Cyanide to a less toxic chemical
 - Cyanide + Thiosulfate forms Thiocyanate

Antidote Kit: Actions

- Quickly form Methemoglobin (~3%)
 - Amyl Nitrite
- Form significant Hemoglobin (25%)
 - Sodium Nitrite IV
- Convert Cyanide to Thiocyanate
 - Administer Sodium Thiosulfate

Sodium Nitrite Hazards

- Correct dosing is critical
- Administer 0.15 ml/kg (45 mg/kg)
 - Adult dose is one 10 ml ampule
 - Correct dose results in 25% Methemoglobin
 - Dose MUST be adjusted for children
 - 300 mg in a small child is lethal
 - Will result in 100% Methemoglobin

Redosing

- May be done if initial response is inadequate
- Thiocyanate may back-metabolize to Cyanide
- Keep unused portion (Thiosulfate) at bedside
 - Consider storing or discarding unused nitrite

Redosing

- Redose Thiosulfate if symptoms recur
 - Severe hypotension
 - Acidosis
 - Reduced arterial to venous pO₂

Supportive Care

- Supportive care is vital
- Response may occur after 30 minutes
- Oxygen has some competitive effects

Cyanide Therapy Investigational Treatment

- Cobalt salts
- Hydroxycobolamin (50:1 mol wt ratio)
 - Thiosulfate should also be administered
- Hyperbaric Oxygen (?)
- Cell-free methemoglobin
- Other methemoglobin inducers (?)
 - 4-Dimethylaminophenol (4-DMAP)
- Nitrite may have additional effect

Nerve Agents

- Cholinesterase inhibitors
 - Temporary then permanent as “Aging” occurs
- Range of persistence (hours to weeks)
- Multiple routes of entry:
 - Oral
 - Inhalation
 - Dermal
 - Parenteral

Nerve Agents in Terrorism

- Aum Shinrikyo Sect - Several instances in Japan

Nerve Agents: Parasympathetic Effects

- S - Salivation & secretions (Rhinorrhea)
- L - Lacrimation & lung
 - Most deaths are pulmonary deaths
- U - Urination
- D - Defecation
- G - GI Effects (nausea, diarrhea)
- E - Emesis & eye effects

Alternate Parasympathetic Mnemonic

- D - Diarrhea
- U - Urination
- M - Miosis
- B - Bradycardia, bronchoconstriction
- E - Emesis
- L - Labrimation
- S - Salivation, secretion, sweating

Nerve Agents: Nicotinic Effects

- Fasciculations
- Muscle weakness
- Flaccid paralysis
- Apnea due to paralysis of muscles

Alternate Nicotinic Mnemonic

- Monday - Mydriasis
- Tuesday - Tachycardia
- Wednesday - Weakness
- Thursday - Hypertension & Hyperglycemia
- Friday - Fasciculations

Nerve Agents Symptom Onset

- Immediate to hours
 - Depends on route of exposure and dose
- Dramatic or Insidious
 - Sudden weakness, LOC, seizures
 - Delayed up to 24° with primarily neuromuscular findings

Nerve Agents Chronic Effects

- Organophosphate Intermediate Syndrome
- Persistent CNS Effects
 - May limit return to duty
 - Resolve with time

Nerve Agents Decontamination

- Remove victim from scene (self protection)
- Remove victim's clothing
- Rinse with water - thoroughly
- Soap is useful
- Effects may persist and worsen for hours after decontamination (liquid, not vapor)
- 10% Clorox is useful

Nerve Agents Decontamination

- Surface decontamination is usually not necessary after vapor-only contact
- Skin Decon: Chlorine Bleach (10%)
- Equipment: alkali solutions (carbonates)

Nerve Agents Treatment

- Decontaminate skin exposure to liquid
- Supportive care
- Specific treatment
 - Atropine 2 mg/injection
 - Pralidoxime (2-PAM) 600 mg per injection
 - Diazepam 10 mg (Army Kits)

Dosing

Category	Signs and Symptoms	Therapy
Minimal	miosis \pm rhinorrhea \pm n/v	< 5 min: 1 Kit > 5 min: Observe
Mild	above + mild dyspnea + n/v	<5 min: 2 Kits >5 min: 0-1 Kit
Moderate	above + moderate to severe dyspnea	<5 min: 3 kits + D >5 min: 3 kits
Moderately Severe	above + severe dyspnea + GI + nm	3 kits, standby vent, diazepam
Severe	above + LOC \pm apnea, seizures	3 kits + ventilator + diazepam

Precautions

- 3 kits may not be adequate
- IM administration may not be effective
 - Hypoperfusion
- Administration of PAM may “uncover” signs of atropine intoxication

Ancillary Care

- Airway management
- Obtain IV access



Alabama Poison Center

800-462-0800
800-222-1222

Certified by the American Association of Poison Control Centers as a Regional Poison Center

Future Programs

Emerging Infectious Diseases and
Bioterrorism Risk

Tuesday, July 20, 2004
12:00-1:30 p.m. (Central Time)

2004 Infection Control & Lab Update
Wednesday, August 11, 2004
2:00-4:00 p.m. (Central Time)